

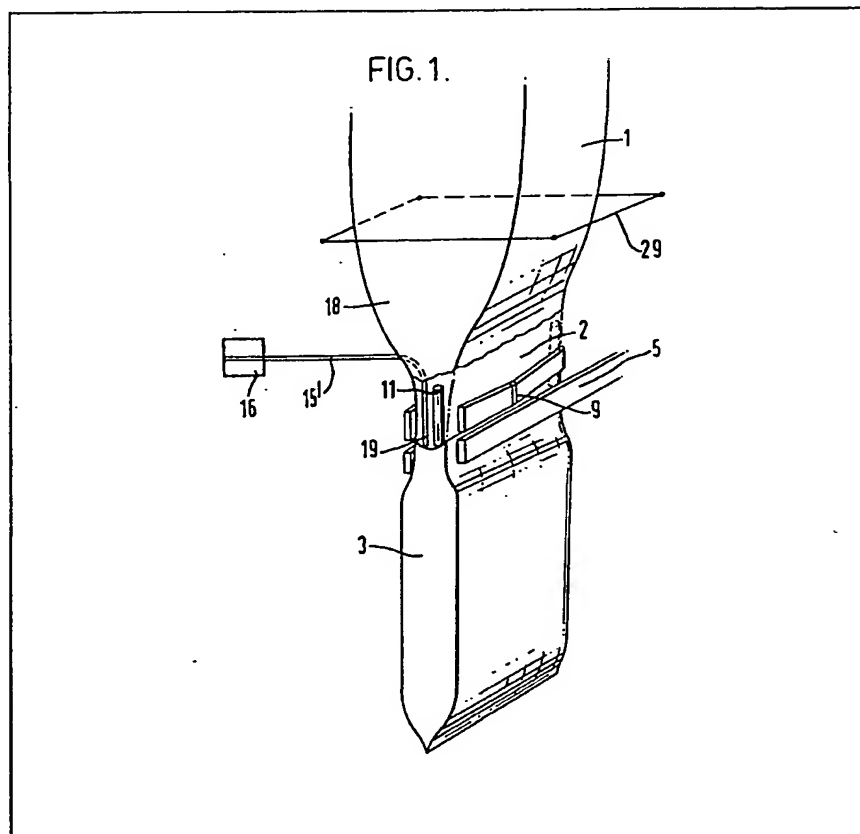
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(54) Packaging apparatus

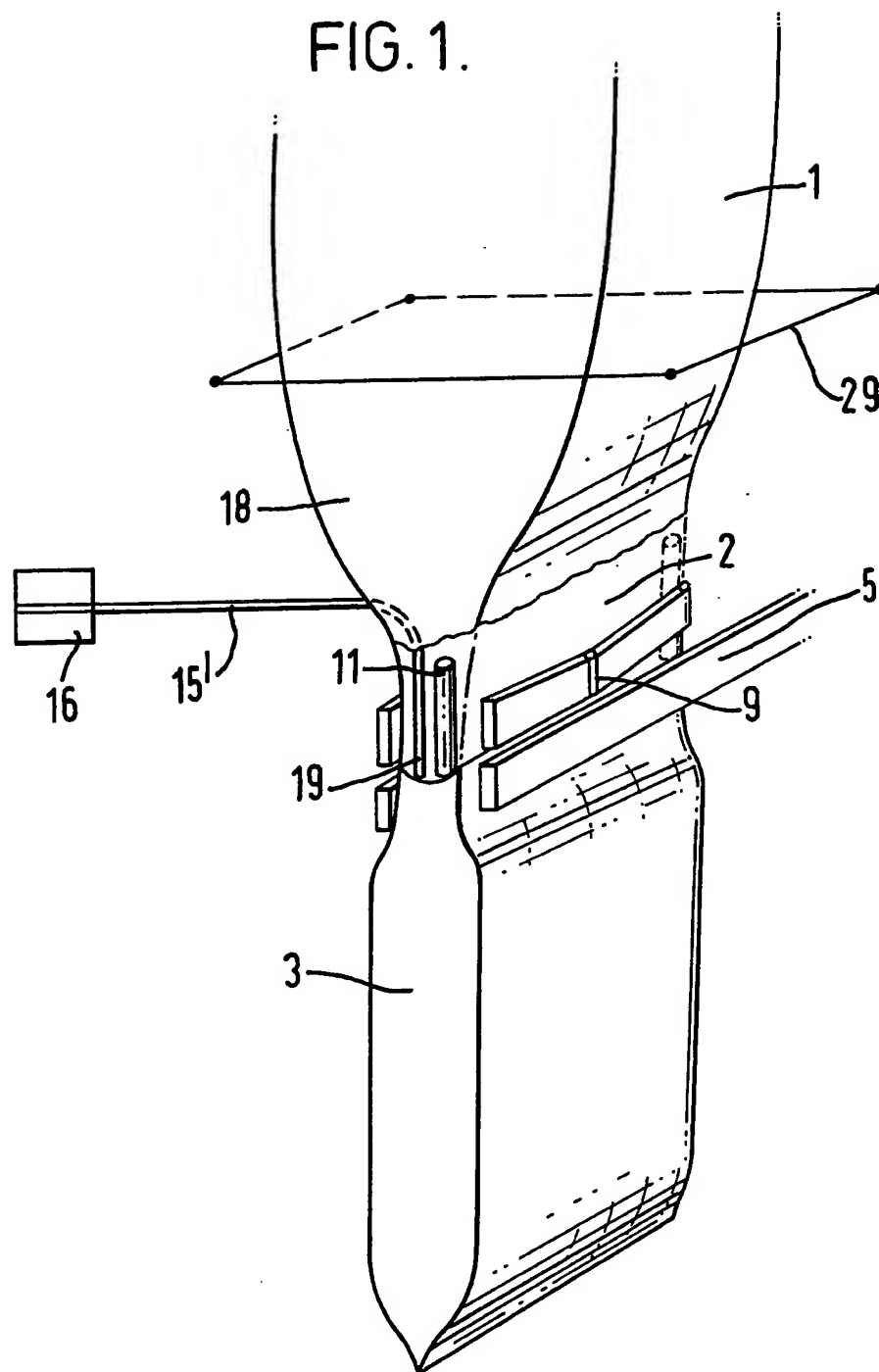
(57) Packaging apparatus for use in de-aeration packaging of materials comprises: supply means for a material to be packaged, the supply means including a conduit (2) having a deformable outlet for extending into an opening of a packaging receptacle (3) to dispense such a material; suction means (15', 19) for de-aerating the receptacle (3); means for holding such a receptacle (3) on the conduit (2) and deforming the outlet to an open condi-

tion for filling and clamping members (5) for clamping the receptacle (3) after filling for de-aeration and transfer to a sealing station. The holding means comprises opposed bars having portions joined by hinges 9, pneumatic jacks being provided to pivot the portions between a parallel position, in which the conduit is closed, and a rhombic configuration, in which the outlet is held open. The outlet may be of elastic material, possibly reinforced by steel blades, and incorporates air-escape tubes 19.

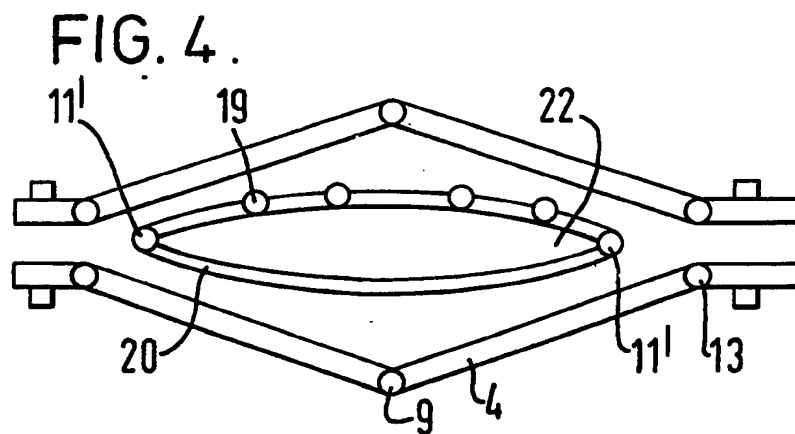
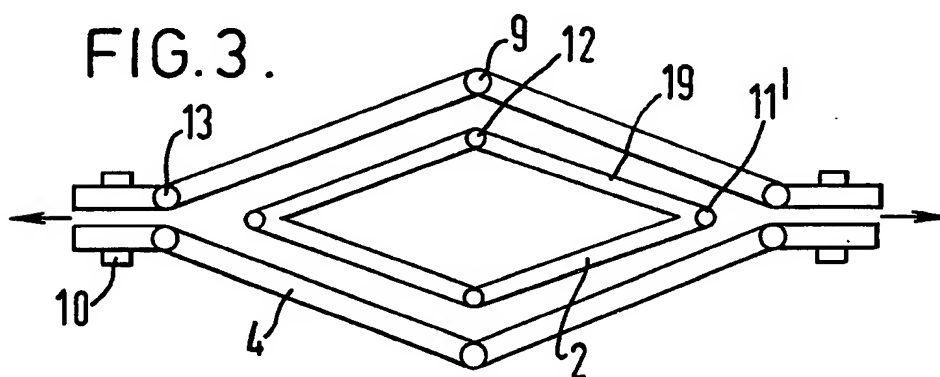
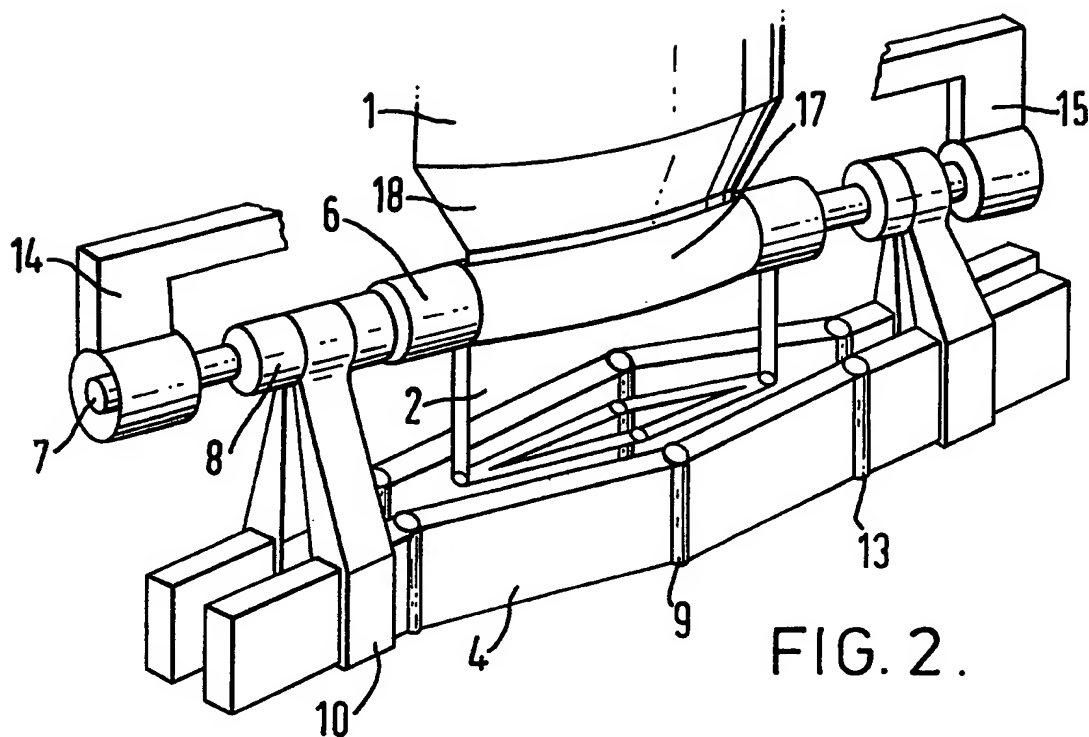


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FIG. 1.



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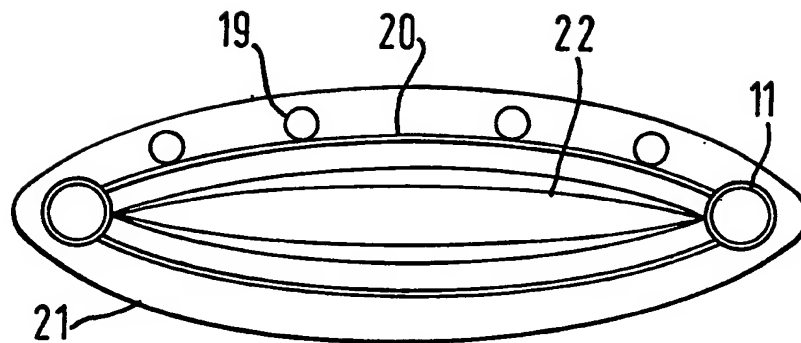


FIG. 5.

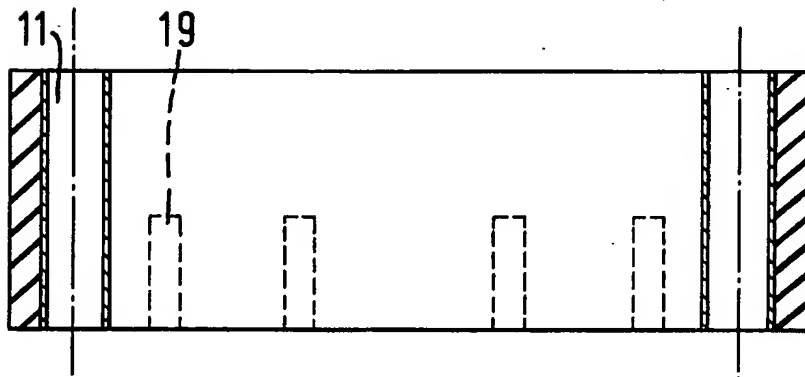
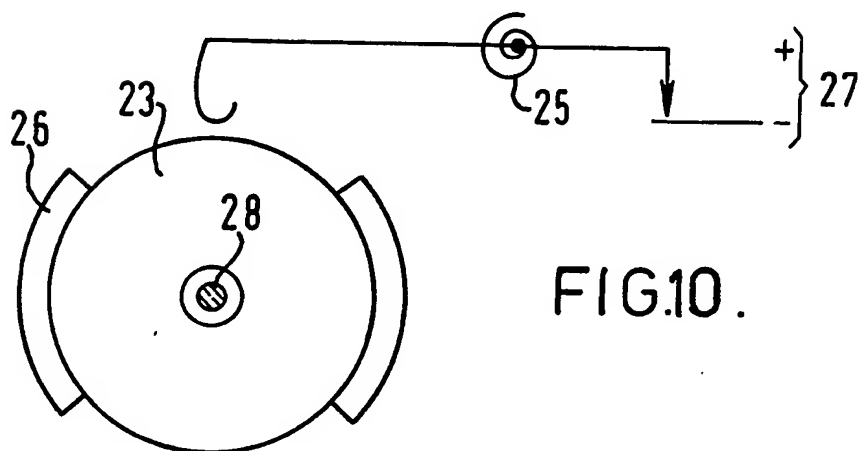
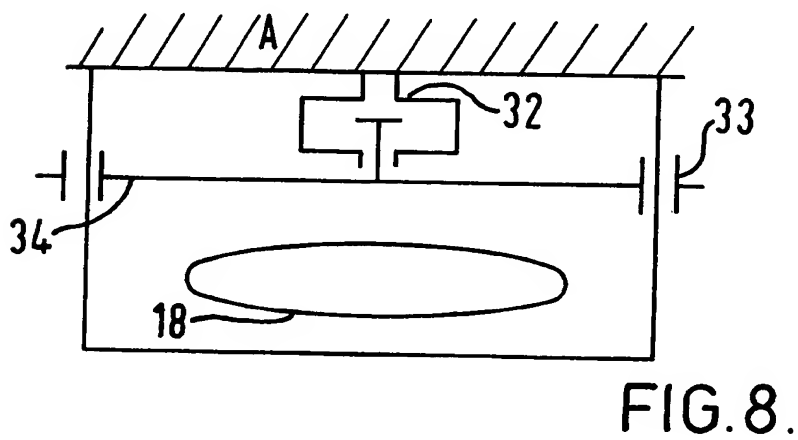
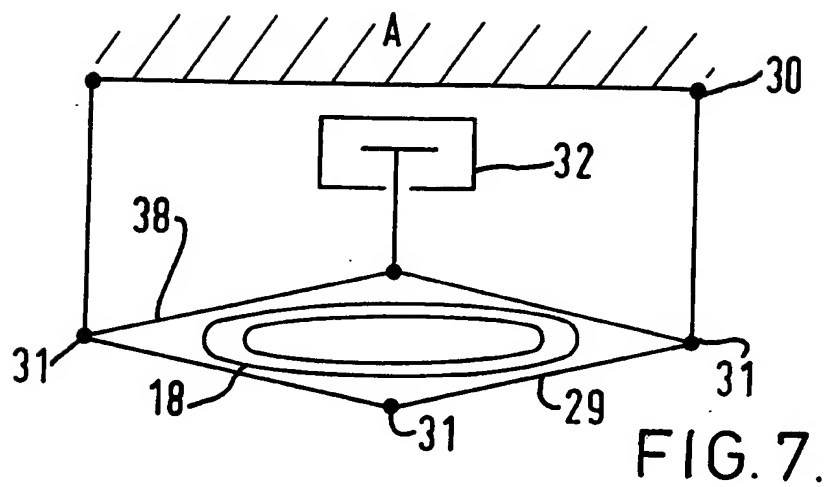


FIG. 6.



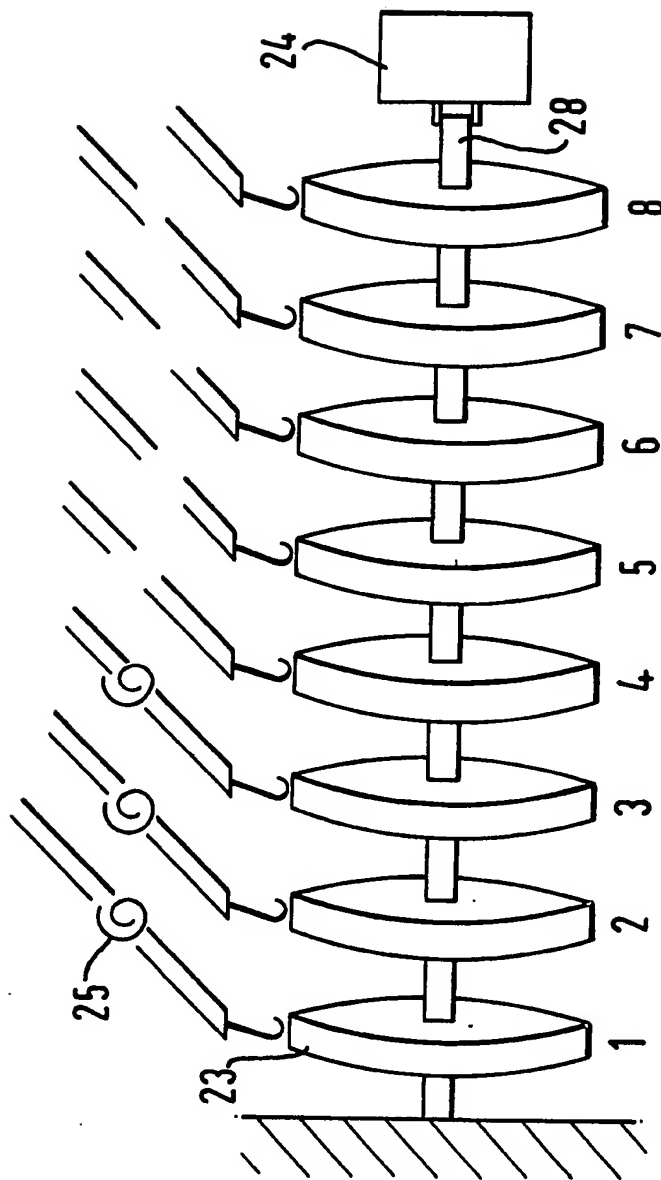


FIG. 9.

SPECIFICATION

Packaging apparatus

5 This invention relates to packaging apparatus for use in de-aeration packaging of materials.

The purpose of de-aeration or vacuum packaging is to store, within a minimum volume, products or materials which are to be protected from air and dampness. This type of packaging considerably reduces the pollution drawbacks associated with usual packaging methods involving the "all sluice-gates open" approach. This advantage is required in the case of a toxic product producing dangerous aerosols, and also prevents deposits on the packaging receptacle surface preventing later closure of the receptacle.

According to the invention there is provided packaging apparatus for use in de-aeration packaging of materials, the apparatus comprising: supply means for a material to be packaged, the supply means including a reshapeable conduit for extending into an opening of a packaging receptacle to dispense such a material; suction means for evacuating such a receptacle; retaining means including first and second retaining members for holding such a receptacle on the conduit; first and second clamping members for clamping such a receptacle after filling of the receptacle with material; and programmable electromechanical control means for controlling operations of the apparatus.

The supply means could further include a hopper for containing material to be packaged, a lower portion of the hopper being connected with the conduit.

The conduit could comprise a plurality of hinged members. Alternatively, the conduit could be made of a flexible material. In the latter case, the conduit could be made of rubber or soft plastics material provided with a reinforcement comprising first and second steel blades.

Preferably, the conduit is provided with an air-escape passageway adapted to connect the interior of such a receptacle with the suction means, for evacuating the receptacle.

Preferably, the suction means comprises a vacuum pump. In this case, the suction means preferably further comprises a tank and an electrically operable valve arranged between the vacuum pump and the air-escape passageway.

The first and second clamping members could be adapted to apply first and second clamping pressures to a receptacle in use, the first clamping pressure being for maintaining a vacuum in such a receptacle and the second clamping pressure being for holding such a receptacle during its transfer away from the conduit to means for sealing the receptacle. Such means for sealing a receptacle could comprise welding means or it could comprise gluing means.

Preferably, the first and second retaining members are arranged to protect the internal and upper surface of such a receptacle from contact with a material to be packaged.

Where the conduit comprises a plurality of hinged

members, said hinged members could each comprise an outer wall and an inner wall, the void between the outer and inner walls being connected with the suction means. Also, these hinged members could be made of metal or a plastics material.

Where the conduit is made of rubber or soft plastics material provided with a reinforcement comprising first and second steel blades, one end of the first steel blade could be connected with one end of the second steel blade via a first hinge and the other end of the first steel blade could be connected with the other end of the second steel blade via a second hinge.

The supply means preferably further includes a flexible sleeve connected between the hopper and the conduit. This sleeve is preferably made of the same material as the conduit.

Compression means could be provided for compressing substantially opposite ends of the conduit to open and close the conduit in use. The compression means could comprise a guide member and first and second jacks arranged on the guide member, each jack being adapted to act on a respective one of said substantially opposite ends of the conduit. The first and second jacks are preferably pneumatically controlled and act on said respective ends of the conduit via first and second hammers respectively, the first and second hammers being slidably mounted on the guide member.

The first and second retaining members could comprise first and second hinged plates respectively.

Said first and second clamping members are preferably adapted to clamp the upper portion of such a receptacle below said first and second retaining members with said first clamping pressures such that the suction means remains in communication with the interior of the receptacle. In this case, the first and second clamping members are also preferably adapted to apply said second clamping pressure such that the interior of such a receptacle is isolated from the atmosphere. The second clamping pressure could be a pressure of several bars (10^5 Nm^{-2}).

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows a schematic view of part of vacuum packaging apparatus according to the invention, with a package in the form of a bag connected with its spout,

Figure 2 shows an example of an arrangement of small, hinged plates for acting on another embodiment of the spout of the apparatus shown in Figure 1 by means of jacks,

Figure 3 shows a horizontal section through a hinged, diamond-shaped embodiment of a spout for the apparatus shown in Figure 1,

Figure 4 shows a horizontal section through a flexible and oval-shaped embodiment of a spout for the apparatus shown in Figure 1,

Figure 5 shows a horizontal section through the lower part of a flexible, one-piece embodiment of a spout for the apparatus shown in Figure 1,

Figure 6 shows a longitudinal section through the

flexible spout shown in Figure 5,

Figure 7 shows a schematic diagram of a horizontal section from below of one embodiment of a closing arrangement for a sleeve of the apparatus shown in Figure 1,

Figure 8 shows another schematic diagram of another embodiment of a closing arrangement for the sleeve of the apparatus shown in Figure 1,

Figure 9 shows a schematic diagram of an electromechanical programmer of vacuum packaging apparatus according to the invention, and

Figure 10 shows a schematic diagram of part of the programmer shown in Figure 9.

Referring to Figure 1, the vacuum packaging apparatus comprises a hopper 1 which is terminated at its lower end by a flexible sleeve 18. This sleeve 18 is made of a soft material which can be closed by a closing arrangement 29 comprising hinged members forming the shape of a distorted parallelogram. The sleeve 18 is terminated at its lower end with a reshapeable conduit in the form of a flexible spout 2 made of rubber, or any other elastic and compressible material.

At the outer ends of the spout 2 are located control pipes 11. The control pipes 11 act as transmission members and are connected with jacks (not shown). The jacks can cause the opening of the spout 2 either by compression or traction, and such opening is synchronized with the hinging of retaining members in the form of hinged plates 4 which apply pressure to the external walls of the spout 2 to ensure air-tightness when filling a packaging receptacle in the form of a bag 3 and during an air-escape operation.

A pipe 15' connects with an air escape system comprising air-escape tubes 19 embedded in the rim of the spout 2. The pipe 15' and tubes 19 facilitate the creation of a vacuum in the bag 3 and its contents by means of valves and electrovalve circuitry 16.

A mechanism (not shown) acts on clamping members in the form of grasping arms 5 to compress more strongly the upper rim of the bag 3 during the transfer operation of the latter to a gluing or welding station.

Referring to Figure 2, the hopper 1, terminated at its lower end by the sleeve 18, can again be seen. Here, a hinged spout 2 is used, and it is necessary to connect it with the sleeve 18 by means of a clamping clip 17. When the plates 4 are folded on their hinges 9 and 13, hammers 6 compress the spout 2 to keep it opened. This compression is obtained by using two pneumatic jacks (mentioned earlier) 14 and 15 arranged to act laterally on hinge-pins 8 which are slidably mounted on a guide 7. This force is communicated, to act in a parallel direction, by means of transmission arms 10 which connect the hinged plates 4 with the hinge-pins 8.

When the spout 2 is to be closed again, the jacks 14 and 15 are caused to reduce their pressure, thus allowing the hammers 6 to be displaced further apart, removing the compression applied to the spout 2 whilst the hinged plates 4 compress the sides of the spout 2 to close it. The hinge-pins 8, by sliding on the guide 7, cause the hinged plates 4

position parallel to the transmission arms 10. The bag 3 (not shown in Figure 2), which is maintained between the spout 2 and the hinged plates 4, can eventually be released by causing the transmission arms 10 to swivel on the hinge-pins 8 so as to separate the hinged plates 4.

Referring to Figure 3, a hinged spout 2 is made of metal or a plastics material and is double-walled to permit the creation of suction via the air-escape void 19 between its walls. This spout 2 is hinged on hinge-pins 11' and 12 to allow it to open and close, and follows, as perfectly as possible, the profile of the hinged plates 4 (which are hinged on their hinges 9 and 13). The arrows indicate the directions of force applied to the transmission arms 10 by the jacks 14 and 15 (not shown in Figure 3).

In Figure 4 a flexible spout 2 comprises two rubber tubes and a steel reinforcement 20. Instead of being double-walled, this spout 2 is provided with the air-escape tubes 19, and applying a force to its hinge-pins 11, more or less opens its opening 22.

Referring to Figure 5, a flexible, one-piece spout 2 comprises rims 21 made of rubber or any other elastic material. These rims 21 define an oval of which the opening 22 of the spout 2 forms the centre. Because the materials forming the spout 2 are not very rigid, a flexible reinforcement comprising two steel blades 20 is provided. These blades 20 are joined at their ends by control pipes 11 which are adapted to operate the spout 2. Alternatively, the reinforcement could comprise a flexible ring which exactly follows the oval shape of spout 2.

In the rims 21 of the one-piece spout 2, air-escape tubes 19 are arranged through part of the height of the spout 2. This arrangement of the tubes 19 is shown more clearly in Figure 6. The flexible, one-piece spout 2 forms an extension of the flexible sleeve 18. This sleeve 18 can be obturated by clamping to accelerate the escape of air from a product being packaged. Furthermore, this arrangement permits stopping of the flow of the product to avoid strain on the rims 21 of the flexible spout 2. Two different methods of closing the flexible sleeve 18 will now be described.

In Figure 7 a clamping arrangement 29, for the sleeve 18, comprising hinged members 38 having a shape of a parallelogram is hinged on hinges 31 and is distorted under the action of an applied force. This force is applied by a pneumatic device 32 supported on a fixed point A. The closing arrangement 29 is distorted under the action of the device 32 and the required closing action is obtained when the hinged members 38 are closed. For easier operation, fixing points 30, supporting the closing arrangement 29 on the fixed point A, are made of flexible material.

Referring to Figure 8, closing of the sleeve 18 in the embodiment shown is obtained by a sliding motion of a member 34 which is operated by a pneumatic device 32. This device 32 could be mechanical rather than pneumatic. For easier operation of this arrangement slide-bars 33 are arranged to slide on four rods arranged in the form of a rectangle. This rectangle cannot be distorted and surrounds the flexible part of the sleeve 18; it remains fixed to a fixed point A and the member 34

slides just enough to obtain the required closing of the sleeve 18.

Referring to Figures 9 and 10, an electromechanical programmer comprises eight cam plates 23 which are arranged to be driven by a synchronous motor 24 which rotates in use at a constant speed. Each plate 23 is supported by a driving axle 28. When the motor 24 is in action it drives the cam plates 23 which are arranged to actuate an electrical contactor 25. Displacement of the brushes of the contactor 25 by superthicknesses 26 located on each cam plate 23 actuates respective electrical contacts of the contactor 25 lasting according to the length of the respective superthickness 26. The electrical contacts of the contactor 25 control the supplies of respective devices of the apparatus, each device being arranged to operate at and for a predetermined time. Thus cam plate No. 1 is adapted to ensure continuous operation of an air escape pump; cam plate No. 2 is adapted to control the jacks 14 and 15 for a predetermined time; cam plate No. 3 is adapted to control the opening and closing of the jacks 14 and 15; and cam plate No. 4 is adapted to control the grasping arms 5 clamping the top of the bag 3, first under a pressure of 2 bars and then under a pressure of 7 bars. The cam plates Nos. 4, 5, 6, 7 and 8 are adapted to ensure different operations, in particular movement of the spout 2 towards the top (i.e. retraction of the spout 2), transfer of the bag 3 to a welding station (not shown), heating and welding of the bag 3, and opening of the electrovalve 13.

The packaging apparatus described above operates in the following manner. A bag 3 is fitted on the spout 2 and the jacks 14 and 15 are controlled by one of the cam plates 23 of the electromechanical programmer to compress the flexible or hinged spout 2 at its ends. This action causes opening of the spout 2 and flowing of the product or material to be packaged from the hopper 1 into the bag 3. When the bag 3 is full, the spout 2 is closed by the displacement of the jacks 14 and 15 and hammers 6, and also by the tightening action of the hinged plates 4 on the walls of the spout 2. The hinged plates 4 apply only a low mechanical pressure to the walls of the spout 2, making it easier to apply a vacuum to the contents of the bag 3, and do not obturate the air-escape tubes 12. Displacement of the grasping arms 5 clamps the bag 3 under a pressure of 2 bars ($2 \times 10^5 \text{ Nm}^{-2}$) to create a vacuum in the bag 3, and subsequently under a pressure of 7 bars ($7 \times 10^5 \text{ Nm}^{-2}$) to transfer the bag 3. Next, the spout 2 is retracted and moved aside and the bag 3 is transferred to a welding station under control of the electromechanical programmer. The welding station comprises electrically-heated rods which clamp and seal, by thermocompression, the non-polluted upper walls of the bag 3 under vacuum, thus making the bag 3 air-tight. After sealing, the bag 3 is released. The apparatus described can be used for packaging powdery, granulated, or pulverized materials rapidly and hygienically. The electromechanical control system has a fast response time. The opening of the flexible or hinged spout 2 remains constant in relation to time whatever degree of wear it has suffered.

The apparatus described offers the following

advantages:

- an increase of working frequency;
- efficiency of packaging by means of a spout which is closable in an air-tight manner;
- minimum of supervision achieved by memorization of the operations by the electromechanical control system;
- minimum time for air-escape; and
- absence of pollution.

CLAIMS

1. Packaging apparatus for use in de-aeration packaging of materials, the apparatus comprising: supply means for a material to be packaged, the supply means including a reshapeable conduit for extending into an opening of a packaging receptacle to dispense such a material; suction means for evacuating such a receptacle; retaining means including first and second retaining members for holding such a receptacle on the conduit; first and second clamping members for clamping such a receptacle after filling of the receptacle with material; and programmable electromechanical control means for controlling operations of the apparatus.

2. Packaging apparatus according to claim 1, wherein the supply means further includes a hopper for containing material to be packaged, a lower portion of the hopper being connected with the conduit.

3. Packaging apparatus according to claim 1 or 2, wherein the conduit comprises a plurality of hinged members.

4. Packaging apparatus according to claim 1 or 2, wherein the conduit is made of a flexible material.

5. Packaging apparatus according to claim 4, wherein the conduit is made of rubber or soft plastics material provided with a reinforcement comprising first and second steel blades.

6. Packaging apparatus according to any preceding claim, wherein the conduit is provided with an air-escape passageway adapted to connect the interior of such a receptacle with the suction means, for evacuating the receptacle.

7. Packaging apparatus according to any preceding claim, wherein the suction means comprises a vacuum pump.

8. Packaging apparatus according to claim 7 as dependent on claim 6, wherein the suction means further comprises a tank and an electrically operable valve arranged between the vacuum pump and the air-escape passageway.

9. Packaging apparatus according to any preceding claim wherein the first and second clamping members are adapted to apply first and second clamping pressures to a receptacle in use, the first clamping pressure being for maintaining a vacuum in such a receptacle and the second clamping pressure being for holding such a receptacle during its transfer away from the conduit to means for sealing the receptacle.

10. Packaging apparatus according to claim 9, wherein the means for sealing a receptacle comprises welding means.

11. Packaging apparatus according to claim 9,

wherein the means for sealing a receptacle comprises gluing means.

12. Packaging apparatus according to any preceding claim, wherein the first and second retaining members are arranged to protect the internal and upper surface of such a receptacle from contact with a material to be packaged.

13. Packaging apparatus according to claim 3, or any of claims 6 to 12 as dependent on claim 3, wherein said hinged members each comprise an outer wall and an inner wall, the void between the outer and inner walls being connected with the suction means.

14. Packaging apparatus according to claim 3, or any of claims 6 to 13 as dependent on claim 3, wherein said hinged members are made of metal.

15. Packaging apparatus according to claim 3, or any of claims 6 to 13 as dependent on claim 3, wherein said hinged members are made of a plastics material.

16. Packaging apparatus according to claim 5, or any of claims 6 to 12 as dependent on claim 5, wherein one end of the first steel blade is connected with one end of the second steel blade via a first hinge, and the other end of the first steel blade is connected with the other end of the second steel blade via a second hinge.

17. Packaging apparatus according to claim 2, or any of claims 3 to 16 as dependent on claim 2, wherein the supply means further includes a flexible sleeve connected between the hopper and the conduit.

18. Packaging apparatus according to claim 17, wherein the sleeve is made of the same material as the conduit.

19. Packaging apparatus according to any preceding claim, further comprising compression means for compressing substantially opposite ends of the conduit to open and close the conduit in use.

20. Packaging apparatus according to claim 19, wherein the compression means comprises a guide member and first and second jacks arranged on the guide member, each jack being adapted to act on a respective one of said substantially opposite ends of the conduit.

21. Packaging apparatus according to claim 20, wherein the first and second jacks are pneumatically controlled and act on said respective ends of the conduit via first and second hammers respectively, the first and second hammers being slidably mounted on the guide member.

22. Packaging apparatus according to any preceding claim, wherein the first and second retaining members comprise first and second hinged plates respectively.

23. Packaging apparatus according to claim 9, or any of claims 10 to 22 as dependent on claim 9, wherein the first and second clamping members are adapted to clamp the upper portion of such a receptacle below said first and second retaining members with said first clamping pressure such that the suction means remains in communication with the interior of the receptacle.

24. Packaging apparatus according to claim 23, wherein the first and second clamping members are

adapted to apply said second clamping pressure such that the interior of such a receptacle is isolated from the atmosphere.

25. Packaging apparatus according to claim 24, wherein said second clamping pressure is a pressure of several bars (10^5Nm^{-2}).

26. Packaging apparatus according to claim 6, or any of claims 7 to 25 as dependent on claim 6, wherein the conduit is provided with a plurality of further such air-escape passageways.

27. Packaging apparatus according to claim 10, or any of claims 12 to 26 as dependent on claim 10, wherein the welding means is adapted to seal the upper portion of such a receptacle by thermocompression.

28. Packaging apparatus substantially in accordance with any example herein described with reference to the accompanying drawings.

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